Framework for Air Quality Management Planning in the Sea-to-Sky Airshed

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BRITISH COLUMBIA

July 2002

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INTRODUCTION

The role of the Ministry of Water Land and Air Protection (WLAP) in air quality management in the Sea-to-Sky airshed includes responsibility for issuing permits and for monitoring compliance for all industrial (point) sources of air pollutants in the airshed (except for those located within the GVRD) as well as responsibility for ambient air quality monitoring in the airshed.

Over the past few years WLAP has observed several indications that air quality in the STS airshed may be at risk. These include the following:

- Air quality monitoring in the southern portion of the airshed has shown concentrations of particulate matter under 10 micrometres in diameter (PM_{10}) and ground-level ozone that occasionally exceed provincial and federal air quality objectives, particularly during summer months.

- It is suspected that the non-industrial (non-point) emissions sources, such as automobiles and residential heating, may be responsible for a large proportion of the total quantity of pollutants released in the airshed.

- Communities in this area have experienced significant population growth and large increases in the number of tourists and recreationalists, and these increases are expected to continue into the future, resulting in concomitant increases in the quantity of non-point source emissions.

- The *Waste Management Act* (WMA) gives WLAP responsibility for waste management (including air emissions) in the province. Regulatory approaches for managing air quality have involved site-specific permits for point source discharges (e.g. pulp mills) and introduction of regulations that target specific activities (e.g. Open Burning Smoke Control Regulation), technologies (Sulphur Content of Fuel Regulation) and consumer products (e.g. Solid Fuel Burning Domestic Appliance Regulation). The historical and current regulatory approaches for addressing air pollution have had limited success.

These concerns have highlighted the need for the development and implementation of innovative strategies and a proactive approach, to address current and future emissions from all significant sources. This can best be achieved through the implementation of an Air Quality Management Plan (AQMP).

An AQMP is a guiding framework designed to maintain or improve air quality in order to protect human health, the environment, and other values. It is a comprehensive road map outlining the actions needed to protect this resource through the use of tools including air quality monitoring, emissions assessment, emission controls, policy development, proactive community planning, and public education.

This report provides an initial overview of the tools and activities needed to help local governments and community stakeholders work together to produce an AQMP for the airshed.

In addition, the Ministry has undertaken several projects to facilitate a better understanding of the proportional contributions of various emission sources, as well as the ambient pollutant concentrations in the airshed. These include the development of an airshed specific emissions inventory and expansion of the ambient air quality monitoring network in the airshed. It is hoped that, together with this report, these projects will provide initial information for local communities and stakeholders to address air quality concerns in the airshed.

1.0 THE SEA-TO-SKY AIRSHED

1.1 Air Quality

The Sea-to-Sky corridor extends approximately 150 kilometres from the Howe Sound entrance at the Strait of Georgia (Vancouver, B.C.) to the confluence of the Pemberton and Lillooet valleys at Pemberton, B.C. (see Appendix A for a map of the STS Airshed boundaries). The airshed[1] has a resident population of approximately 30,000 and includes the communities of Bowen Island, Gibsons, Horseshoe Bay, Lions Bay, Squamish, Whistler, and Pemberton. Air quality in the Sea-to-Sky airshed is becoming a significant environmental issue as rapid population growth and commercial development continues in an airshed that already experiences a significant quantity of emissions.

The natural surroundings of the Sea-to-Sky's corridor are among the regions greatest assets, and have been drawing increasing numbers of people to the area. Whistler's population has increased by 24% between 1996 and 2001 (Statistics Canada, 2002). According to the 2001 Canada Census (Statistics Canada, 2002), Whistler is one of the 25 fastest growing Municipalities in Canada and the only Municipality in BC included on this list. Both Gibsons and Squamish have also experienced substantial growth over the past decade (Statistics Canada, 1997, 2001). There are significant numbers of people who commute between Whistler and Squamish and between Whistler and Pemberton for work (BC Transit, 2001). In addition, this region is becoming more popular every year for tourists and recreational users, translating into potentially large increases in automobile traffic and community developments. As this region continues to grow, the maintenance of a healthy environment, and a "super natural" image and experience will be a very important challenge.

The Sea-to-Sky airshed possess geographical features that have the potential to produce poor air circulation, leading to the build-up of pollutants, particularly during periods where high-pressure systems prevent pollutant dispersion Although the area in which pollutants can disperse in the southern portion of the Sea to Sky Airshed is wider in Howe Sound, the narrow valley (often less than 2 km wide) that forms north of Squamish and extends up to Pemberton is bounded topographically on both sides by mountains, many of which are over 1000 m high. In general, the winds in the Sea-to-Sky valley and Howe Sound follow a north and south pattern. In winter, when large-scale, low-pressure systems dominate the area, winds are generally from the northwest to northeast. In summer, however, the dominating high pressure systems produce winds from the south. This is enhanced by a land-sea breeze that draws winds from the south into the mountains due to daytime heating of mountain slopes. Thus, under summer conditions when the air is often stagnant and polluted in the Greater Vancouver region, air quality problems are exacerbated because polluted air is often channelled up the narrow valley into the Sea to Sky Airshed communities. In the Sea-to-Sky airshed, pollutants of particular concern are ground-level ozone, PM_{10} and particulate matter under 2.5 micrometres in diameter ($PM_{2.5}$).

Currently there are two main air quality monitoring stations in the Sea-to-Sky Airshed, both located at the southern end of the airshed. A monitoring station is located in downtown Squamish and is operated by Western Pulp & Paper (Woodfibre, B.C.). Ambient measurements are taken for SO_2, TRS (total reduced sulphur), and PM_{10}. WLAP also runs a ground-level ozone monitor and $PM_{2.5}$ sampler from this site. Although the first four contaminants are measured continuously, the $PM_{2.5}$ is obtained once every six days, according to the National Air Pollution Surveillance (NAPS) schedule. There are at least five years of continuous data available for all these pollutants.

Meteorological data are also collected at the downtown Squamish site, including detailed data on wind speed and direction, temperature, and relative humidity. Data have been collected since the 1980s and are

[1] An airshed is defined as the mass of air contained within a definite boundary (usually defined by topography).

continuous. Western Pulp and Paper also operates a meteorological station (i.e. wind speed and direction, temperature) at the Woodfibre mill.

Howe Sound Pulp & Paper (Port Mellon, B.C.) operates a monitoring station at Langdale Elementary School, which collects measurements for NO_2, NO, SO_2, PM_{10}, and TRS. There is no ground-level ozone monitor at this site. There is data available over the last four years, with a one-year gap. Meteorological data is not currently collected at the Langdale ferry terminal but hardware remains in place and the station is expected to be reactivated in 2003. There is long-term historical meteorological data available that was previously collected at this site. Howe Sound Pulp & Paper also operates a meteorological station (i.e. wind speed and direction, temperature) at the Port Mellon mill.

In 2002, additional non-continuous monitoring instruments have been installed. A PM_{10} HiVol is now located at Garibaldi Highlands Elementary (Squamish, B.C.), and a $PM_{2.5}$ and PM_{10} sampler is located at Brackendale Elementary (Brackendale, B.C.). These two new stations follow the NAPS 6-day sampling schedule.

A continuous ozone monitor was installed in April 2001 at the Whistler Meadow Park Sports Centre and a continuous NOx analyzer will be added to the station in 2003. A continuous $PM_{2.5}$ monitor and a non-continuous PM_{10} monitor are expected to added to the station in the next couple of years.

In order to obtain a more complete overview of ambient air quality in the airshed, increased monitoring in the upper section of the airshed would be desirable. The addition of a meteorological station in this area of the airshed would also provide valuable information pertaining to air movement.

Ambient air quality monitors in Squamish have recorded ground-level ozone and PM_{10} readings comparable to levels found in Chilliwack - which experiences some of the worst air quality in the Lower Fraser Valley. However, unlike the latter airshed, which has been widely considered to have an air quality problem, the potential for similar future air quality issues in the Sea-to-Sky Airshed has not been adequately considered. Although air quality in the Sea-to-Sky airshed is for the most part good, the rapid population growth and growth in recreational and tourist industries, with their consequent increase in automobile emissions and new residential and community developments, could produce air quality issues in the future as serious as those found in the Lower Fraser Valley. The communities in the Sea-to-Sky airshed have the opportunity to recognise these potentialities early and to work proactively to minimize risks to human health and to the health and sustainability of the local environment, before issues that are more serious arise.

1.2 Emission Inventory Estimates

An "emission inventory" is an accounting of all sources of air pollution within a defined geographical area and provides information on the types of emissions, their sources, and the quantity of contaminants emitted within a specific geographical area.

A 1995 emission inventory for the Sea-to-Sky Airshed was prepared in 2002. Five contaminants (carbon monoxide, nitrogen oxides, sulphur oxides, volatile organic compounds, total particulate matter [with PM10 and PM2.5 breakdowns]) were inventoried with emission estimates grouped into four categories (point, area, mobile, and natural) based on emission source:

- **point sources** - stationary industrial/commercial facilities authorized to discharge air emissions under a *Waste Management Act* permit, approval or regulation, or a MWLAP Solid

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Waste Management Plan, or under an air discharge permit issued under GVRD's Air Quality Management Bylaw No. 937.

- **area sources** - residential, light industrial, commercial, and institutional sources that are normally not required to obtain Ministry or GVRD authorization. Due to the numbers and diffused nature of these small sources, emissions are estimated collectively. Anthropogenic area sources include agricultural practices, miscellaneous burning (prescribed burning, structural fires, etc.), gasoline marketing, landfills, tobacco, solvent evaporation, space heating etc.

- **mobile sources** - non-stationary sources, primarily those involved in the transportation of people and goods. For this emissions inventory, the mobile sources are divided into 5 subcategories, namely, on-road motor vehicles (light-duty and heavy-duty vehicles), aircrafts, railways, marine vessels and off-road sources (agriculture vehicles, lawnmowers, etc.)

- **natural sources** - refers to emissions that occur naturally without the influence of humans (nonanthropogenic). Natural sources include categories such as wildfires, biogenics (vegetation), wildlife, and marine aerosol (airborne particulates produced by wind activity and wave movement of salt-water bodies).

For the Sea-to-Sky Emissions Inventory report, the airshed was divided into two regions, namely the Lower Sea-to-Sky (LSTS) airshed and the Upper Sea-to-Sky (USTS) airshed. The LSTS airshed includes Gibsons, Horseshoe Bay, and the municipality of Squamish; the USTS airshed includes the resort municipality of Whistler and the village of Pemberton. The purpose of the division was to highlight the fact that the main industrial sources (including the two pulp mills) are found in the lower section, whereas the upper section represents sources that are more closely related to tourism and residential activities.

Results of the Sea-to-Sky emissions inventory indicate *point sources*[2] are the greatest source of carbon monoxide, sulphur oxides, total particulate, PM_{10} and $PM_{2.5}$ emissions for the airshed; the greatest source of nitrogen oxides and volatile organic compound emissions within the airshed appear to be from *mobile sources* and *natural sources*, respectively. The dominant source contributors differ when the results are viewed for the upper and lower sections, and the observed results are likely a reflection of industrial source emissions primarily occurring in the lower section of the airshed. For the LSTS airshed, *point sources* are the greatest contributors of CO, SOx, $PM_{2.5}$, PM_{10} and total particulate; the greatest source of nitrogen oxides and volatile organic compound emissions appear to be from *mobile sources* and *natural sources*, respectively. For the USTS airshed, *area sources* are the greatest contributor of CO, $PM_{2.5}$, PM_{10} and total particulate. *Mobile sources* are the greatest source of SOx in the USTS airshed and, similar to the LSTS airshed, the greatest source of nitrogen oxides and volatile organic compound emissions appear to be from *mobile sources* and *natural sources*, respectively. Dominant source contributors within the upper, lower and entire (i.e. upper+lower) Sea-to-Sky airshed, based on the 1995 Sea-to-Sky Emissions Inventory, are summarized in Table 1.0.

[2] In 1995, there were 27 permitted air discharges in the Sea-to-Sky airshed.

TABLE 1.0 DOMINANT EMISSION SOURCES IN THE SEA-TO-SKY AIRSHED[1]

Pollutant	Lower Sea-to-Sky Airshed	Upper Sea-to-Sky Airshed	Upper+Lower Sea-to-Sky Airshed
NOx	mobile (51%)	mobile (86%)	mobile (56%)
CO	point (59%)	area (46%)	point (50%)
SOx	point (74%)	mobile (67%)	point (70%)
VOC's	natural (68%)	natural (80%)	natural (72%)
$PM_{2.5}$	point (64%)	area (68%)	point (55%)
PM_{10}	point (62%)	area (69%)	point (55%)
total particulate	point (61%)	area (70%)	point (54%)

[1] based on 1995 Sea-to-Sky Emissions Inventory Summary Report, road dust was not included in the above source contribution summary

2.0 AMBIENT AIR QUALITY

2.1 Objectives and Standards

In order to develop policies and plans to ensure good air quality, ambient concentrations corresponding to particular "levels" of air quality must first be defined for each pollutant of concern. These pollutant concentrations represent air quality objectives and standards. They act as measuring sticks, which are used, together with ambient air quality monitoring, to determine when pollutant concentrations are at desirable or undesirable levels.

In Canada, three classification systems have been developed to perform this function: National Ambient Air Quality Objectives; Canada Wide Standards; and Reference Levels. National Ambient Air Quality Objectives (NAAQO) have been defined for all major air contaminants of concern including, among others, the criteria pollutants and the trace metals. These objectives are meant to provide guidance for policy development and are not binding. Samples of NAAQO levels can be found in Table 2.0.

Three levels of ambient air quality are defined for these federal objectives: Maximum Desirable, Maximum Acceptable, and Maximum Tolerable. The pollutant concentrations corresponding to each level of ambient air quality are temporally averaged over 1 hour, (8 hours for CO), 24 hours, and one year. These levels of ambient air quality are defined as follows:

- The **maximum desirable** level defines the long-term goal for air quality and provides a basis for an anti-degradation policy in unpolluted areas.
- The **maximum acceptable** level is intended to provide adequate protection against adverse effects on humans, animals, vegetation, soil, water, materials, and visibility.
- The **maximum tolerable** level is determined by time-based concentrations of air contaminants. When air pollutants reach this level of concentration, appropriate action is required without delay to protect the health of the general population

Provincial ambient air quality objectives have also been defined for the air contaminants (Table 2.0). These objectives are meant to serve the same purpose as the NAAQO. The pollutant concentrations corresponding to each level of air quality differ somewhat from the federal objectives for some pollutants.

The provinces have the option to set more stringent objectives (but not less stringent) than the national objectives for air pollutants. The provincial ambient air quality objectives are also divided into three categories, Level A, B, and C. These categories correspond generally to the definitions associated with the federal categories with Level A corresponding to the Desirable designation, Level B to Acceptable and Level C to Tolerable. In addition to those listed in Table 2.0, a provincial ambient air quality objective exists for PM_{10}. The provincial PM_{10} objective is 50µg/m^3 over a 24-hour averaging period.

TABLE 2.0 AMBIENT AIR QUALITY OBJECTIVES

Pollutant	Averaging Period	Federal Objectives (µg/m^3)			Provincial Objectives (µg/m^3)		
		Maximum Desirable	Maximum Acceptable	Maximum Tolerable	BC Level A	BC Level B	BC Level C
Sulphur dioxide (SO_2)	1 hour	450	900		450	900	900-1300
	24 hour	150	300	800	160	260	360
	annual	30	60		25	50	80
Total Reduced Sulphur (TRS)	1 hour				7	28	
	24 hour				3	6	
Nitrogen Dioxide (NO_2)	1 hour		400	1000			
	24 hour		200	300			
	annual	60	100				
Ozone (O_3)	1 hour	100	160	300			
	24 hour	30	50				
	Annual		30				
Carbon Monoxide (CO)	8 hour	6000	15000	20000			
	1 hour	15000	35000				
Particulate Matter (PM_{10})	24 hour					50	
	annual						
Total Suspended Particulate (TSP)	24 hour		120	400	150	200	260
	annual	60	70		60	70	75

The Canadian Environmental Protection Act Federal/Provincial Working Group on Air Quality Objectives and Guidelines (Federal/Provincial Working Group) also develops air quality objectives to protect people and the environment from adverse effects associated with airborne pollutants. The Federal/Provincial Working Group develops "Reference Levels" which are defined as levels, above which, there are demonstrated effects on human health and/or the environment. Reference levels have been developed for $PM_{2.5}$ and PM_{10}.

Canada Wide Standards (CWS) have been developed for $PM_{2.5}$ and ground-level ozone (CCME, 2000). These standards were developed in response to growing concern over the effects of these two pollutants on human health and the environment. They are meant to provide nationwide standards to guide the development of emissions reductions and policy for these pollutants. The standards were derived through a study of scientific findings on the risks to human health and the environment associated with these pollutants, and by balancing the desire to protect human health with economic and social considerations associated with reductions in ground-level ozone and PM_{10} emissions. Reference Levels for PM_{10} have been recently put forward. These reference levels attempt to set ambient concentration levels for particulate matter that will be more fully protective of human health. However, it must be remembered that to date, no threshold levels for $PM_{2.5}$ or ground-level ozone have been determined below which no adverse health effects are experienced in the population.

2.2 Potential Effects of Poor Air Quality

Poor air quality can present serious risks to human health. However, many of these risks have been underestimated in the past. Ground-level ozone and PM_{10} have been associated with adverse health effects including: eye and throat irritation, coughing, decreased lung capacity, increases in respiratory illnesses such as asthma and bronchitis, increases in hospitalisations due to respiratory conditions, and increases in premature deaths. No threshold levels for PM_{10} or ground-level ozone have been determined below which no adverse health effects are experienced. Children, the elderly, and those with pre-existing respiratory conditions comprise the segments of the population most at risk (GVRD 1994, CEPA/FPAC (1999); World Health Organization, 1999).

There are also several potential environmental impacts associated with poor air quality. Increasing levels of PM_{10} and $PM_{2.5}$ can result in poor visibility, obscuring the scenic views that are of particular importance to the areas' tourist and recreational industries. Increased levels of ground-level ozone result in photochemical smog and can damage foliage, reduce crop yields, and increase plants' susceptibility to disease, as well as accelerating the deterioration of materials such as rubber and plastics. (GVRD, 1994, CEPA/FPAC (1999))

3.0 AIR QUALITY MANAGEMENT PLANNING

3.1 What is Air Quality Management Planning ?

Air Quality Management Planning is simply a process aimed at improving ambient air quality in a defined area (usually an airshed) while maintaining jobs and economic potential. An AQMP targets all air pollution sources in the airshed - from domestic woodstove emissions to large industrial point source emissions. The process is dynamic, and ongoing, with extensive public and stakeholder participation/consultation key to the success of an AQMP. Fundamental components of the process include characterization of existing air quality, identification of existing air pollution problems and sources, public and stakeholder participation/consultation, prioritization of air quality issues,

identification of short and long-term strategies to improve air quality, and implementation of emission reduction measures.

The provincial government has implemented a variety of regulatory measures and programs intended to protect and improve ambient air quality (the goal of an AQMP). While implemented strategies have targeted activities on a province-wide scale, they can (and have) significantly influenced air quality at the local and regional level. Examples of such strategies include the regulation of air discharges through the issuance of permits under the provincial *Waste Management* Act and the introduction regulations and programs such as the Open Burning Smoke Control Regulation (B.C. Reg. 208/96), Gasoline Vapour Control Regulation (B.C. Reg. 226/95), Sulphur Content of Fuel Regulation (B.C. Reg. 67/89), Solid Fuel Burning Domestic Appliance Regulation (B.C. Reg. 302/94), Motor Vehicle Emissions Control Warranty Regulation (B.C. Reg. 116/96), Motor Vehicle Emissions Reduction Regulation (B.C. Reg. 517/95), Solid Fuel Burning Domestic Appliance Regulation (B.C. Reg. 302/94) , Cleaner Gasoline Regulation (B.C. Reg. 498/95), and emissions testing programs (e.g. AirCare).

It is important to note that the successful improvement and protection of ambient air quality depends to a significant degree on the attitudes and actions (lifestyles) of individuals in each community, particularly for non-point source emissions. A provincial (or federal) strategy does not reach individuals easily without the planning and implementation of complementary local initiatives and public education, which help to raise public awareness and encourage modification of behaviours and attitudes in the local community. Strategies and measures implemented at higher levels of government may not be the most appropriate to meet a particular community's needs because local concerns and interests cannot be easily represented or addressed at the provincial or federal level. Also, parties with provincial or federal jurisdiction do not have the authority to deal with many of the local issues affecting air quality (e.g. Official Community Plans and zoning, certain aspects of local transportation infrastructure, etc); therefore, their actions can have only limited impact. For this reason, local and regional leadership is key in the development of comprehensive and effective solutions to air quality issues.

3.2 Why Initiate Air Quality Management Planning ?

The public, businesses, institutions, and governmental agencies are becoming increasingly aware of the importance of preventative and proactive actions in ensuring that human health is protected, and a sustainable, healthy environment is maintained. The air we breathe is one of the most basic requirements in all our lives. Therefore, keeping our air clean and breathable is very important to all of us. Taking proactive action to ensure that this most basic resource will be protected is in all our best interests.

As our communities grow, increasing quantities of materials are released into our environment, putting increasing pressure on the resilience and assimilative capacity of our natural surroundings, and our own health. By evaluating the potential effects of current and future planned activities, proactive strategies and plans can be developed that will help to ensure that present and future activities will support and maintain good community and environmental health and sustainability. This is the main purpose of air quality management planning.

Air quality is related to many important issues in the community including:

- community health,
- the management of industrial operations,
- transportation growth and alternatives,

- community growth and development,
- the vitality of economic sectors including tourism,
- business practices, and
- community lifestyles.

The development of an AQMP provides a framework for addressing the protection of air quality in relation to these issues; allowing for all members of the community to contribute to the development of effective strategies that sustain and improve air quality while meeting the community's needs. This planning process can lead to many benefits for the communities involved including the following:

1. Contributing to the maintenance of good community health by planning for the preservation of good air quality.

   There are potentially serious health impacts associated with poor air quality especially for children, the elderly, and those with existing respiratory conditions. It has been calculated, in other jurisdictions (Bovar Environmental et. al., 1993) that the implementation of measures developed through Air Quality Management Planning can lead to significant improvements in overall community health.

2. Producing a positive image to potential visitors, investors, and residents that these communities and the businesses therein are acting proactively to maintain a healthy and attractive community and environment.

3. Giving all members of the local community a voice in shaping strategies to address air quality and related issues in their respective communities, including local governments, industry, business, community groups, environmental groups, First Nations, and other interests.

   The AQMP process provides opportunities for these interests to work directly with local and provincial governments to produce mutually desirable plans. This approach can lead to a greater commitment to the successful implementation of the strategies developed because community members are directly involved in their development.

4. More effectively addressing ambient air pollutant levels by addressing issues pertaining to all emissions sources, from large point sources to the cumulative effects of numerous small area and mobile sources.

   Cooperative planning allows for the consideration of a wider range of sources, thus increasing the number of options available for reducing emissions.

5. Providing opportunities for the development of creative and innovative solutions to air quality concerns that go beyond the "end of the pipe" solutions often relied on in the past, and can tailor these solutions to address the specific circumstances present in the local community.

6. Providing the tools and potential partnerships to ensure that the principles associated with managing for the improvement and maintenance of good air quality are effectively incorporated into ongoing community and economic planning.

7. Facilitating the coordination of initiatives between jurisdictions, which have responsibility over various aspects of air quality management and its related issues.

   Providing agencies with the forum to share information, expertise, and resources, more easily, in recognition that air pollutants travel between jurisdictions and, to an extent, between airsheds.

8. Providing the framework and tools to determine to what extent air quality has changed over time, allowing communities to respond in a timely manner to ensure that good air quality is maintained.

3.3 Air Quality Management Planning Tools

3.3.1 Emission Inventories

Emission inventories have become a major tool in the development of air quality management plans, and information from an emissions inventory can be used to determine which steps should be taken in an air quality management plan in order to reduce harmful emissions and to improve ambient air quality.

An emissions inventory provides an estimate of the quantity of air contaminants emitted by each emissions source in the airshed, and thus allows for the ranking of emissions sources. Estimates are calculated using permit data (e.g. flow rate x concentration x duration), or, by the product of a base quantity (e.g. number of vehicles, number of units produced, forest area etc.) and an emission factor. These estimates can assist in the identification of the significant emissions sources in the airshed and facilitate the development of strategies to reduce pollutant emissions from identified sources. Caution must be used when interpreting the results of an emissions inventory and it is important to take into account the limitations of the methods used. Proration of emissions can lead to overestimation or underestimation of particular source types. For example, use of population statistics for proration of a parameter may underestimate the contribution of certain area emissions sources (e.g. space heating) by not taking into account seasonal increases in visitors to the region. Despite their limitations, emissions inventories remain a valuable tool in the planning process. WLAP's Water, Air and Climate Change Branch develops a province-wide emissions inventory every five years.

3.3.2 Baseline Level Emissions Forecasts

Baseline level emissions forecasts are used for the prediction of future emissions levels. The procedure is similar to that followed in the preparation of an emission inventory except that in this case projections are being utilized as opposed to estimates of current emissions sources. The basic procedure for developing these forecasts involves obtaining population growth projections and economic indicator data for likely future scenarios, and inputting these data into calculations in conjunction with their associated levels of air contaminant emissions. These forecasts predict the likely level of future emissions, given predicted economic and population growth. Often several different "scenarios" are run for these forecasts to represent the various potential combinations of population growth and community development likely, given particular future circumstances. Baseline models assume that no new emissions reduction measures will be introduced. However, existing measures and strategies are taken into account, a "business as usual" approach, thus providing a baseline estimate for future emissions levels. Emissions reduction strategies can then be designed to target potential future priority air contaminants. These forecasts are

particularly necessary in the development of an effective AQMP in areas where future population and community growth are expected to be significant.

It would be preferable to run several scenarios including a basic scenario, which takes impacts due to predicted population growth and consequent development into account. Other scenarios would be run to estimate the impact of large potential future developments such as Whistler's bid for the 2010 Olympics, or proposed all-season resort developments (such as Garibaldi at Squamish).

3.3.3 POLLUTANT MODELLING

Models can be used to estimate how existing ambient air quality can be affected by current emissions, as well as how various combinations of emissions controls may affect ambient air quality. In this way, these models may be used to estimate the emissions reductions required by sources in the airshed to meet ambient air quality goals.

There are three basic types of models often used in air quality management planning: receptor, dispersion, and empirical models. Receptor or apportionment models use information gathered at the receptor site along with information on characteristics of the sources to infer the contribution of various sources to the concentrations of pollutants measured at the receptor site. This is done by relating the chemical and physical properties of pollutants found at the receptor site, to emissions from particular sources. Receptor model results can be useful in targeting management efforts to sources that are significant contributors to identified priority pollutants in the airshed. Receptor modelling is also useful in refining emission inventory estimates for sources that are poorly characterized (e.g. road dust emissions).

Dispersion models are predictive using information from sources along with meteorological, topographical, and land-use data to predict the movement of pollutants in the airshed. These models can be used to determine the level of emissions reduction needed to meet ambient air quality goals, or to determine the effect of a proposed future development.

These types of modelling projects would be very useful in determining which sources are contributing most significantly to ambient pollutant concentrations found at receptor sites. It would also add to the understanding of diurnal and seasonal variations in pollutant concentrations, originating from particular sources, found at receptor sites. Studies of temporal variation of pollutant emissions could potentially be very valuable since temporal (daily and seasonal) information on emissions is not available through the current emissions inventory development process.

Empirical models can also be used to predict ambient pollutant concentrations. These models use historical air quality data in conjunction with meteorological data to establish relationships between air quality levels and related factors. (GVRD, 1994)

Currently, Environment Canada is involved in the Pacific 2001 Study, aimed at increasing our understanding of the composition and processes involved in the formation and dispersal of particulate matter and ground level ozone in the Lower Fraser Valley. More information on the Pacific 2001 Study can be found at http://www.msc.ec.gc.ca/projects/pacific2001/index_e.html.

3.3.4 AMBIENT AIR MONITORING

Ambient air quality and meteorological monitoring is key in the development of an AQMP. Ambient monitoring allows existing ambient air quality to be characterized and potential pollution sources to be identified, which leads to the identification of potential management strategies to protect and improve ambient air quality. Ambient monitoring data can also be utilized to model identified management strategies and assess their potential effectiveness in achieving the goals of the AQMP. Ambient monitoring is also key in the assessment of an AQMP as it allows for the assessment of management strategies implemented to protect and improve ambient air quality.

3.4 Cost / Benefits of Air Quality Management Planning

Assessment of the benefits and costs associated with air quality management planning is important since many proposed measures are expensive to implement. To move forward, it must be demonstrated that there are net benefits to AQM planning. Some of the benefits that can be accrued through improved air quality are:

- improved human health leading to reduced health costs,
- improved environment (ecosystem) health,
- increased crop (including forestry) yields,
- reduced damage to materials, and
- improved visibility (which can positively affect the tourism industry).

Other jurisdictions, which have implemented AQMPs, have calculated that net benefits can be achieved through the implementation of these plans. A Draft Cost/Benefit Study (Bovar Concord Environmental et. al., 1994) was prepared for the GVRD AQMP. The study projected emissions reductions of nitrogen oxides (NOx), volatile organic compounds (VOCs), sulphur oxides (SOx), carbon monoxide (CO), and particulate matter to 2020, and estimated the benefits to human health and to the economy accrued by addressing the major air quality issues. These results were then compared to the costs of implementing the Plan. Visibility was not included in this analysis due to unavailability of related damage/costs data.

Using base case conservative assumptions, it was determined that the AQMP would generate $1.6 billion in net benefits to the regional economy and GVRD residents over its lifetime (total benefits $5.4 billion, total costs $3.8 billion). The figures were discounted at 4% per year to 1993 dollars. Thirty-four percent of estimated control costs were taken up by mobile source controls, with 54% and 12% going to point and area source controls, respectively.

In addition, this study found that the AQMP would prevent 2,800 premature deaths, 33,000 hospital emergency room visits, 13 million restricted activity days, and 5 million air quality related symptoms. The majority of prevented premature deaths are associated with reductions in PM10, while the reductions in chest discomfort and other symptoms are related to reductions in ground-level ozone. The long-term health benefits of the AQMP in monetary terms amount to 51 cents per person per day. Crop losses due to ozone are expected to decrease by 1% to 4% per year for the next several decades as a result of the

AQMP. The damage averted to materials and property in dollars saved per ton of pollutant reduced is estimated to range from $30 for VOC to $180 for particulate matter.

While the Sea-to-Sky Airshed and the Lower Fraser Valley airshed differ in climate, physiography, sources/types/quantities of air emissions etc., it is reasonable to conclude that similar benefits, while not the same in terms of numbers, could be realized in the Sea-to-Sky airshed.

One notable benefit of establishing an AQMP is the likely increase in public and stakeholder participation and investment. Public and stakeholders would likely have increased confidence in investing resources in an airshed where there is a long-term management strategy to improve air quality while maintaining jobs and economic potential.

4.0 PROPOSED PLANNING PROCESS FOR THE SEA-TO-SKY AIRSHED

4.1 Stage One: Airshed Characterization

1. Prepare an Ambient Air Quality Report. This report should provide an analysis of current and past air quality for the monitored pollutants (PM_{10}, TRS, NOx, SO_2 and O_3), in the airshed. Trends in air quality should also be presented. The report should discuss current knowledge on the role of regional meteorological conditions in air quality, in terms of pollutant formation, stagnation, and dispersal as well as current knowledge on the observed diurnal and seasonal patterns of pollutant concentration (particularly O_3 and PM). The report should assess current air quality issues (priority contaminants) in the area and this information should be compared to neighbouring jurisdictions with similar issues. The report should also discuss potential health impacts associated with measured levels of ambient air pollutants and identify information/data gaps in understanding ambient air quality in the airshed and provide recommendations on filling information/data gaps.

2. Distribute the Ambient Air Quality Report. Circulate the report to pertinent municipal, provincial, and federal governmental departments, and other potential partners and stakeholders. Communicate the desire to begin a proactive air quality management planning process.

3. Publicize the findings of the Ambient Air Quality Report. Information should be presented in the local media, and on the AQMP partners' web sites, relating the need for proactive air quality management planning in the area. Topics to be presented could include:

    - a summary of current and past ambient air quality,
    - a brief explanation of current air quality objectives, the Air Quality Index, and the air quality monitoring program,
    - proposed future research (i.e. emissions inventory, etc.), and
    - potential health and environmental risks associated with air pollutants.

In addition, context for the process should be provided by referring to AQM planning initiatives elsewhere (GVRD, Williams Lake-Quesnel, Prince George, Bulkley Valley, etc.), and their benefits. The

benefits of the development of an AQMP at the airshed level as opposed to current provincial/federal strategies alone should be included.

4. Develop an emissions inventory. An emissions inventory has been developed from the Provincial Emissions Inventory data (1995) prepared by the Water, Air and Climate Change Branch using the Air Contaminant Emissions Model (ACE). This emissions inventory quantifies emissions from all local sources of air pollution. A subsequent more comprehensive and current inventory may be required.

5. Develop a Baseline Level Emissions Forecast. This will aid in prioritizing air quality management issues and emission reduction measures. This forecast will provide an estimate of future emissions levels, given growth and currently implemented emission reduction measures. If feasible, projections for associated future ambient air quality using air quality modeling techniques should also be provided. Note that the emissions forecast should not be performed using emissions data obtained through the emissions estimates produced from the 1995 emissions inventory. Rather this study should be conducted only if current, comprehensive airshed specific emissions inventory data is available.

4.2 Stage Two: Forming Partnerships, Setting Air Quality Management Goals and Prioritizing Air Quality Issues.

1. Present the findings of the Emissions Inventory and forecasts in a Background Report to potential partners. A discussion of the current and predicted future major emissions sources, along with the relevance of these findings to the Ambient Air Quality Report, and the likely priority air quality issues in the area, should be presented. A review of the research findings on health and environmental risks associated with poor air quality should be included. In addition, a general review of relevant planning processes initiated in other jurisdictions, including a summary of the costs and benefits associated with these programs, would also be beneficial. Finally, include a summary of recommendations for the planning process.

2. Establish an AQMP Working Group with partners. Develop goals for the AQMP and establish a framework and Action Plan for the planning process.

3. Hire or designate a Planner or Planning Committee to coordinate and support the AQM planning process. The Planner's responsibilities will include co-ordination of the planning process including organising and chairing of Air Quality Working Group (AQWG) meetings, and organising public and stakeholder consultation events. The Planner will provide resources and information to partners, stakeholders, and the general public, both during development and implementation of the Plan. This role will also include preparation of educational materials for the public. The Planner will be primarily responsible for the compilation and drafting of the AQMP document.

4. Establish priority air quality issues and priority sources for reduction after giving consideration to the following:

   - ambient air quality monitoring and emissions inventory data
   - published scientific studies and recent research findings
   - public and stakeholder input

The GVRD (GVRD, 1994) prepared formal criteria to prioritize air quality issues to determine those for which Emissions Reduction Measures (ERMs) would be developed. These guidelines may also prove useful in the Sea-to-Sky AQM planning process. Several priority levels were developed.

- Highest priority is given to issues where the current air quality objectives are not being met, or where there are projected significant impacts to human health or the environment.

- Second priority is given to issues where there are significant impacts or high potential for significant impacts and current initiatives are not projected to reduce impacts, however, further research is needed to determine viable options for the amelioration of the problem.

- Third priority is given to issues where impacts are intermittent and generally do not present a risk to human health or the environment, or current emission reduction measures will produce an improvement in air quality over the next decade, or impacts must be further assessed to determine the nature and extent of the problem.

5. Produce a brochure that introduces the concept and need for air quality management to the public. This brochure should provide an explanation of the process of air quality management planning, and how the public can get involved. A summation of current priority air quality issues should be included along with a synopsis of current research findings on the health and environmental effects of air pollutants. An overview and breakdown of the current and predicted future contributions of local source sectors to emissions of air pollutants, and available options for reducing emissions from these sources should be presented. In this brochure, emphasis should be given to emissions reduction options in which the public can play a direct role (a "What You Can Do" approach).

6. Distribute the Brochure, and post it on relevant web pages. Make a copy of this brochure available on the AQMP partners' web sites with links to more detailed information. Provide hardcopies to community stakeholders and partners for their information. Distribute copies to the general public at AQMP informational and consultation events, and by request.

7. Publicize ongoing steps taken toward improving air quality. This could include the publication of on going ambient air quality monitoring results, interim measures adopted to improve air quality by business, industry or community groups, and progress made in the planning process. The local media (newspapers, local TV and radio stations) should be kept well informed of new developments through interviews, news releases etc. New developments should also be published over the Internet on the AQMP partners' and other interested groups' web sites.

8. Provide opportunities for public discussion and consultation. This can be accomplished through open houses, workshops, and/or forums. Opportunities to provide feedback by mail, and email through the AQMP partners' web sites, should also be publicized. Possible topics for discussion at this stage could include the proposed priority air quality issues and priority emissions sources in the airshed, air quality management, and the AQM planning process.

9. Identify further monitoring and research requirements. Discuss options for cost sharing and partnerships with AQMP partners. Consult with neighbouring jurisdictions to coordinate air quality monitoring and research efforts and to explore opportunities for partnerships on future projects of mutual interest.

4.3 Stage Three: Develop Emission Reduction Measures and Finalize AQMP

1. Establish a process for development of Emission Reduction Measures (ERMs). With partners, determine for which sources emission reduction measures/strategies/initiatives will be developed to address the priority air quality issues. Develop a proactive process for the development of options for emission reduction strategies and measures for these sources.

2. Assess potential ERMs. Assess the various options for their effectiveness with regard to reducing emissions and meeting ambient air quality goals, technical feasibility, cost effectiveness (costs vs. benefits analysis), and social acceptability through consultation with partners, other jurisdictions that have implemented similar measures, published research findings (as appropriate), stakeholder consultation, and consultation with the public. Include opportunities for public and stakeholder input on the potential ERMs through stakeholder working groups that are also open to the public.

3. Co-ordination with neighbouring jurisdictions. Work with neighbouring jurisdictions to coordinate emissions reduction measures and programs.

4. Develop implementation schedules for the selected Emission Reduction Initiatives. This should be accomplished through the analysis of related costs and potential funding, available technology, etc., in consultation with partners.

5. Develop the Draft AQMP. Circulate the draft plan among partners, stakeholders, and the public. Revise the Plan as a result of this consultation process.

4.4 Stage Four: Implementation & Monitoring

1. Initiate implementation of the emissions reduction measures. Provide support to industry and community groups, which are implementing emissions reduction measures and programs. Publicize steps taken to implement the AQMP and encourage public involvement. Assess programs and measures to ensure effectiveness in terms of meeting air quality management goals.

2. Continue ambient air quality assessment program. Continue to monitor ambient air quality and expand the monitoring program as required. Complete air quality modeling projects recommended in the AQMP. Utilize knowledge gained from these assessments to assess progress and to make revisions as needed to meet AQMP goals.

3. Produce an annual Air Quality Status Report. This report will evaluate progress in meeting air quality management goals. Include an assessment of current air quality and mid-term air quality trends. New information gained from air quality modelling should also be included.

4. Publicize progress in meeting AQMP goals. Keep the public and stakeholders informed on progress made towards meeting the AQMP goals. Seek feedback from stakeholders and the public.

5. Revise and refine emissions reduction measures. ERMs may be revised as a result of new monitoring and research findings, new technological development, and/or new community needs, in consultation with partners, stakeholders and the public.

5.0 POTENTIAL PLANNING TOOLS FOR THE AQMP

If it is determined that local community activities and subsequent emissions can not be estimated to the desired level of accuracy by provincially developed data, it may be desirable to hire consultants experienced in the preparation of **emissions inventories** to produce a comprehensive airshed specific inventory for the STS Airshed.

It is recommended that a consultant be hired to produce **baseline level emissions forecasts** since experienced staff could more easily produce credible results.

Undertaking **air quality modelling** specific to the STS airshed is not likely to be a realistic endeavour at the current time. At present, there is insufficient historical and current ambient air monitoring data to portray a geographically representative depiction of air pollutant concentrations throughout the airshed (air pollutant monitoring activity is concentrated in the Southern portion of the airshed). In addition, there is limited historical meteorological data for modelling purposes. As the AQMP proceeds, partnerships with other agencies and expansion of air quality monitoring in the airshed may allow for the use of these models.

6.0 SETTING GOALS FOR THE AQMP

Before an AQMP can be developed, the desired outcomes or goals of the plan must be established. Goals to direct the development of an AQMP generally fall into two broad categories. The goals may focus either on emission reduction targets or on attainment targets for ambient air pollutant concentrations.

6.1 Emission Reduction Targets

An across-the-board reduction in emissions, e.g. a goal of reducing total emissions in the airshed by 50%, represents an emission reduction target. Emissions reductions can also be targeted at particular source sectors. For instance, if it is determined through an emissions inventory that automobiles are the major source of emissions in an airshed, the goals of the AQMP may be to develop strategies to reduce automobile emissions by a certain percentage. Another variation on these goals is to target particular contaminants for emissions reduction. Certain contaminants such as PM_{10} and ground-level ozone are associated with serious health and environmental risks. As a result, major sources of these contaminants may be targeted for reduction to protect human health and the environment. The disadvantage of emission reduction goals is that it is difficult to predict whether air quality will improve to desired levels by meeting these goals.

6.2 Attainment Targets for Ambient Air Pollutant Concentrations

Attainment targets for ambient air quality concentrations focus on ambient concentrations of air pollutants. For example, a non-degradation policy may be set where strategies are developed to maintain the current level of ambient air quality into the future while accounting for population growth and further industrial and economic development. Alternatively, AQMP goals may focus on reductions in pollutant concentrations to agreed contaminant concentration limits. This could include developing policies and strategies to meet Level A or Desirable air quality objectives, or to meet the standards set by CWS or Reference Levels. Ambient goals can thus also be specifically targeted toward particular contaminants.

7.0 PARTNERSHIPS AND AQM PLANNING

7.1 Potential Partners for the Sea-to-Sky AQM Planning Process

The leadership of Municipal governments and Regional Districts in the STS airshed will be essential, since local governments have both the jurisdictional authority and local community relationships to ensure that community needs and goals will be met when developing the community specific plans, for the maintenance and protection of air quality, involved in an AQMP. This is especially true if the focus of the AQMP is to minimize emissions from non-point sources.

Other important partners recommended for the successful development of an AQMP for the STS airshed are outlined below.

The involvement of Coast Garibaldi Community Health Services (CGCHS) as a partner in this planning process is important. There are potentially serious health concerns associated with air pollutants. Ensuring that these concerns are accurately communicated to the public and AQMP partners, and effectively addressed, as well as ensuring that access to information on health impacts experienced by the local population is made available, will be important. The expertise, community health related data, and community contacts, which CGCHS can provide, will be very helpful.

Other agencies and governmental departments, which would be valuable partners at various points in the AQM planning process, include the following:

- Ministry of Water, Land and Air Protection (ambient air quality monitoring, permitting of point sources)
- Ministry of Transportation and Highways (currently working on a multi-modal study for Highway 99 transportation alternatives),
- Ministry of Forests (with regard to prescribed burns in the area),
- Environment Canada (pollutant modelling and other research concerning air quality),
- GVRD (coordination of GVRD AQMP initiatives with the STS airshed AQMP),
- BC Transit (further development of public transit between communities),
- BC Ferry Corporation (emissions from vessels, as well as ferry related automobile traffic),
- BC Gas (determining feasibility of natural gas as an alternative energy source to wood burning)

The Squamish First Nation, N'Quatqua First Nation, and the Mt. Currie Band must be kept informed throughout the planning process. They should be consulted as to what role they would be interested in playing in the development of the Plan. Proposed measures to address air quality issues, especially those related to community development, should include First Nations input.

Partnerships with business representatives, such as the Chamber of Commerce, will be important. The Chamber could work as a liaison between the local business community and other AQMP partners, to give local business a voice in the development of community based strategies to protect air quality. The

Chamber could also be involved in the development of effective strategies to raise local business's awareness of practices that will help them to minimize their emissions of air contaminants, including best management practices, and workplace employee transportation programs.

Community groups should also be approached. They provide an important perspective, which can be helpful in the development of balanced solutions to the air quality issues facing this area. In addition, they can aid in raising community awareness of air quality issues and potential solutions. They can also provide potential volunteers to work on various initiatives and programs.

7.2 Potential Roles and Responsibilities of Airshed Partners

7.2.1 Municipal Governments

- Providing leadership in the development of initiatives and programs that support the goals of the AQMP
- Ensuring that the improvement and maintenance of good air quality is taken into account in Official Community Plan development and revision
- Working proactively with other agencies and levels of government to co-ordinate, facilitate, and implement the development of initiatives that will reduce emissions from area and mobile non-point sources
- Bylaw development that supports maintenance of good air quality

7.2.2 Ministry of Water, Land and Air Protection

- Setting and enforcing permitted emissions levels for point sources
- Providing technical support for the collection of ambient air quality monitoring and meteorological data
- Analysis of ambient air quality data
- Providing advice on bylaw development
- Providing clarification on applicable provincial legislation and regulations
- Helping to inform the public of issues related to air quality

7.2.3 Ministry of Health

- Providing community health related information
- Acting as a resource, to partners and stakeholders, for information on the most recent findings on health risks associated with air pollutants

7.2.4 ENVIRONMENT CANADA

- Providing advice on options for air quality modelling and resource requirements for this activity.
- Developing modelling data in partnership with other AQMP partners for use in the Sea-to-Sky airshed
- Providing clarification for applicable federal legislation as required including CEPA, US/Canada Air Quality Accord, NOx Protocol (1988) and VOC Protocol (1991) of the UN Economic Commission on Europe, etc.
- Source of scientific research and studies related to air quality issues such as Pacific 2001
- Regulator of vehicle emissions and fuel standards

7.2.5 ENVIRONMENTAL AND COMMUNITY GROUPS

- Involvement in the development of initiatives to encourage the reduction of emissions from non-point sources of air contaminants
- Increasing public awareness of air quality related issues and what the public can do to reduce their emissions through participation in the development of public education programs, and the development and distribution of educational materials
- Providing input throughout the planning process to help ensure that proposed strategies are the most effective in meeting community needs and protecting the environment

7.2.6 BUSINESS AND INDUSTRY REPRESENTATIVES (CHAMBER OF COMMERCE)

- Presenting considerations of importance to local business/industry to the other planning partners and acting as a liaison between business/industry and the AQMP planning process
- Providing information and tools to local business/industry that can be used to implement changes that will help to improve and maintain good air quality

8.0 INTERJURISDICTIONAL CO-ORDINATION

Airshed boundaries are not synonymous with political boundaries. As a result, coordination between neighbouring jurisdictions has been viewed as essential in the development of effective AQMPs. The Sea-to-Sky airshed includes areas falling under the jurisdiction of three regional districts: the Greater Vancouver Regional District; the Squamish-Lillooet Regional District; and the Sunshine Coast Regional District. Coordination between these regional districts and their member Municipalities, located within the STS airshed, will be necessary. Additionally, since the GVRD (GVRD, 1994) and FVRD (FVRD, 1998) have already prepared AQMPs for areas under their jurisdiction, coordination of current and future emission reduction measures and programs between the STS airshed, GVRD, and FVRD will be desirable.

9.0 CONSULTATION

9.1 Public and Stakeholder Involvement

Consultation with the public and stakeholders will be an essential component of the air quality management planning process. It is important that the public and stakeholders be given a wide range of opportunities to provide input and feedback throughout the planning process for two reasons:

1. To ensure that all voices in the community have an opportunity to be heard.

2. To ensure that the Plan is developed, at each stage, in a direction that will ultimately meet the community's needs while helping to maintain good air quality.

9.2 Major Elements of Public and Stakeholder Consultation

The aims of public and stakeholder consultation activities are:

1. To provide opportunities for the public and stakeholders to gain knowledge about air quality issues and potential solutions.

2. To provide opportunities for the public and stakeholders to share their views on various elements of the Plan.

Major elements of public and stakeholder consultation include:

- Equitable representation of all segments of society - including marginalized groups
- Transparent and accountable role of planning agencies and local government authorities
- Open, two-way dialogue between public and planning agencies
- Early involvement of public in planning process, to allow for an active role in shaping subsequent decisions
- Provision of adequate resources for multiple opportunities and methods to involve public

Source: Bhattacharyya, Kamal K. (1999) Urban Air Quality Management: A Framework for Development and Implementation. World Health Organization.

Public and stakeholder consultations were seen to be highly valuable in other AQMPs (Williams Lake-Quesnel, GVRD, Prince George) in terms of generating innovative ideas and workable solutions, and for the early identification of potential difficulties. The involvement of the public and stakeholders will facilitate their commitment to the process and will allow them multiple opportunities to participate actively in decision making.

9.3 Key Steps in the Consultation Planning Process

1. Identify the extent of public consultation necessary
2. Develop an initial plan to establish objectives, identify potential participants and decide on consultation topics
3. Develop a detailed plan by determining the methods of consultation, types of information materials needed, and schedules for consultation
4. Hold consultation and obtain input
5. Analyze and consolidate input and prepare report
6. Seek post-consultation feedback from participants

Source: Bhattacharyya, Kamal K. (1999) Urban Air Quality Management: A Framework for Development and Implementation. World Health Organization.

9.4 Options for Public and Stakeholder Consultation

There are several options available for providing public and stakeholder consultation opportunities, some of which were found to be useful in other AQMP planning processes. Some of these options are outlined below.

Open houses provide a good opportunity for members of the public to obtain information from the AQMP partners on the planning process, potential air quality issues, health and other impacts, and potential solutions. They can provide both opportunities for one-on-one responses to questions, and for the presentation of an overview of air quality issues and the planning process. Open houses were found to be a useful tool in both the Prince George (Oster, 1997) and Williams Lake-Quesnel (Earle Plain, pers. comm.) AQMP development processes, in terms of raising public awareness.
Public forums tend to be more formal processes where partners present particular aspects of the issue(s) to be discussed, and members of the public are given an opportunity to respond, ask question, and raise concerns (GVRD, 1993).

In addition to holding open houses and public forums, providing a range of educational materials outlining the proposed AQMP process, and impacts of air pollutants on human and environmental health are important steps in the consultation process. For example, Williams Lake-Quesnel prepared a brochure to introduce the public to air quality management and the air quality issues in the area. The GVRD produced a large variety of informative publications on air quality management and related issues, as well as utilising the media extensively by releasing air quality study results and providing interviews on air quality related issues.

Public surveys can also be used to gauge the public's opinion on air quality management, to provide insight into the public's priorities and willingness to participate in and support the implementation of various initiatives. As part of Prince George's planning process, a formal survey was conducted by telephone to solicit this type of information (Oster, 1997).

Workshops can provide an opportunity for discussion in smaller working groups, each of which focuses on a particular topic or aspect of the larger issue. For example, a workshop could be held to obtain input

on proposed emissions reduction measures where working groups are formed for different stakeholder groups, which then discuss proposed initiatives and generate ideas in areas of particular interest to them. This technique was used in both the Prince George (Oster, 1997) and GVRD planning processes to obtain input from stakeholders on proposed emissions reduction options and other issues.

Another potential forum for obtaining regular feedback from stakeholders can be achieved through the establishment of an Advisory Committee. The GVRD convened an Air Quality Advisory Committee (AQAC) to obtain input from stakeholders throughout the AQMP planning process. The GVRD Air Quality Advisory Committee consists of approximately 35 members. The AQAC included representation from federal, provincial, and municipal governments, GVRD and FVRD, public health, business and industry, UBC air quality researchers, BC Hydro, BC Transit, and environmental groups. AQAC meetings are also open to the general public.

Staff at the GVRD also stressed the importance of providing incremental results throughout the planning process, so that tangible progress can be demonstrated to the public and stakeholders. Announcements such as new initiatives by local industry or improvements to the local transportation system were found to be very effective means for maintaining momentum and interest. (Patrice Rother, Personal Communication)

A list of stakeholders in the Sea-to-Sky airshed is provided in Appendix B. This list is not exhaustive but provides representative groups for the major interests in the various communities in the airshed. A more comprehensive list can be prepared as the process moves forward.

10.0 OVERVIEW OF AVAILABLE TOOLS FOR REDUCING EMISSIONS

10.1 Command and Control

The command and control approach is characterized by governmental regulations, setting of authorized emissions levels (i.e. *Waste Management Act* discharge permit), checking for compliance, and setting of penalties for noncompliance. This has been the most common approach adopted in air quality management. Advantages and Disadvantages of the "Command and Control" Approach are summarized below.

Advantages

- Public confidence
- A degree of certainty in industry
- Relative ease in measuring compliance

Disadvantages

- Costly in terms of employees needed to monitor compliance and in terms of legal fees for non-compliance cases
- Provides little flexibility for the development of comprehensive and creative solutions to pollution issues

- To focus largely on "end of the pipe" solutions to air quality issues
- Does not provide incentives for industry to maximize pollution reductions (below the allowable levels)
- Often requires far more stringent standards for new facilities than those already in operation
- Tends to focus emissions controls on large point sources while leaving smaller area and mobile sources under regulated, or unregulated

Source: Bhattacharyya, Kamal K. (1999) Urban Air Quality Management: A Framework for Development and Implementation. World Health Organization.

10.2 Economic Instruments and Incentives

Economic instruments and incentives can aid in both the implementation of, and compliance to, emissions reduction measures/strategies by providing operations or individuals with benefits to participation in these initiatives. They may include investment incentives, tax policies (differential taxes), environmental charges (load based charges), user charges (road tolls, true cost pricing of resources), permit fees, and subsidies.

There are a variety of options available for the development of proactive tax policies. Higher taxes for leaded gasoline and environmental taxes on pesticides are examples of policies that encourage the minimization of use of higher polluting alternatives.

Another method to influence consumer choices toward more sustainable behaviors is to decrease subsidies to industry in order to encourage conservation. This could include, decreasing energy subsidies, especially for dirtier fuels, encouraging efficient energy use and developing new, less polluting alternatives. Introducing subsidizes for low emission alternatives is another option.

10.3 Pollution Prevention

This approach attempts to minimise the quantity of pollutants produced by instituting changes in production techniques, use of less polluting raw materials, and recycling of waste materials. The development and use of "clean" technologies to replace the older, higher polluting techniques is also included here. Education and awareness-raising are important components in the advocacy of this approach. Certification programs and other forms of recognition can be helpful incentives in recruiting business, and to an extent, individual citizen's participation in these initiatives.

10.4 Co-regulation

Co-regulation can be a very useful tool since it takes some of the responsibility, and potentially, some of the costs of monitoring compliance from government. In addition, solutions can be developed which are better tailored to particular sources, and which are considered as practical and realistic by those sources. Co-regulation is characterized by the formation and adoption of rules, regulations and guidelines in consultation with stakeholders, which are negotiated within prescribed boundaries. The main advantage of this approach is its collaborative process that takes industry expertise into account, and its proactive approach. It has resulted in the voluntary adoption of environmental standards in some cases. The role of government would be to produce guidelines for industry in terms of socially expected emissions

outcomes, however, industry would largely determine the means by which these outcomes can best be achieved.

10.5 Self-Regulation

Self-regulation involves the self-imposition of regulations and guidelines, and voluntary environmental audits. It is characterized by the voluntary adoption of environmental management measures. Examples for business and industry could include voluntary emission reduction targets, self-audits, or codes of conduct.

Self-regulation is an especially important option in reducing emissions from area and mobile sources, since these sources can not be easily targeted through the traditional command and control approaches. In order to promote these behavior and lifestyle changes at the individual business or citizen level, public and stakeholder education will have to play an important role.

10.6 Transportation Control Measures

Emissions from private automobiles will likely comprise a very significant portion of total emissions in the airshed. For this reason, potential strategies that could help to encourage reductions in these emissions will be considered separately here.

Transportation Control Measures (TCM) comprise a broad range of strategies aimed at reducing pollutant emissions released into the airshed by motor vehicles through reductions in the total number of kilometers driven by single occupancy vehicles. Workplace ride-share programs, parking management, encouraging trip reduction through place of work and work schedule modifications, are all examples of potential TCMs. Providing employees with incentives to use alternate transportation (biking and walking), when traveling to and from work, by providing support facilities for these alternatives such as showers and bike lockers, is another potential option.

Support and guidance for employers in setting up these initiatives can be found through the Go Green Program. Manuals on a variety of these initiatives are provided, which outline a systematic approach for establishing them. The Go Green program also offers a one-day course to train employees as Go Green coordinators. Further information can be obtained from their web site at www.gogreen.com.

Health Canada offers its "Go for Green" program that encourages "active transportation" including the "Active and Safe Routes to School" initiative. This initiative encourages families to use active modes of transportation to get their children to school while using safe routes. More information on this initiative and others offered by the Go for Green Program can be found at www.goforgreen.ca
Vanpools can be organized through the Jack Bell Foundation, a non-profit organization that offers this service between Squamish and Vancouver for $120-150 per month.

Another alternative lies with Transportation Demand Management. TDM initiatives can reduce vehicle emissions by making better use of the existing transportation network. Examples of TDM measures include expansion of public transit networks, and economic incentives for trip reduction such as "road pricing" measures including gas taxes, bridge tolls, and parking charges.

10.7 Proactive Community Planning

This approach refers to land use planning in communities that takes the conservation of environmental resources, including air quality, into account when making planning decisions. Initiatives could include ensuring that industrial sources of air pollutants are not located near or up wind from residential developments. It can also include the planning of neighbourhoods to encourage the use of alternate transportation. This can be accomplished by including a mix of residential development, commercial enterprises, and recreational facilities within each neighborhood, thus, reducing resident's dependence on their automobiles. Improved transit options, and expanding bike paths and pedestrian friendly routes (or pedestrian only zones) as well as developing facilities to support these alternatives (e.g. providing secure bike lock-ups throughout the community), also fit into this approach.

10.8 Episode Management

Episode Management Plans detail actions to be taken by industry and/or the public during poor air quality episodes. Episode management can act as an effective tool for reducing air pollution related problems (such as risk to human health) during high-risk periods.

11.0 EMISSION REDUCTION MEASURES

The type and scope of emissions reduction measures considered are determined largely by the goals established for the AQMP. The results of the emissions inventory, which determines major sources of air pollutants in the airshed, the Ambient Air Quality Assessment results, which help to determine priority pollutants for reduction, and information available on associated health and environmental risks, are all important considerations when developing potential ERMs. In addition, technical considerations and resource availability will play significant roles in the scope of emission reduction strategy options.

11.1 Assessment of Emissions Reduction Measures

Each potential Emission Reduction Measure must be assessed to determine the amount of emissions reductions possible with its implementation, and to determine the costs to industry, governments, and consumers of implementation and monitoring of compliance (where applicable), versus the benefits to society associated with its implementation.

Quantifying the benefits in terms of dollars, for the purpose of comparison to associated costs, can be difficult since many benefits such as visibility improvement and improved human health or avoided health impacts, are difficult to quantify. However, it is necessary to ensure that the costs of implementing particular control measures, which are often very expensive, are compensated for by benefits of equal or greater value. (GVRD, 1994)

Some of the key areas that should be considered when selecting potential emission reduction initiatives are listed below:

1. **Pollutants**. Which pollutants will be reduced by the ERM?

2. **Quantity of emission reduction**. How much emission of each pollutant will be reduced? Will the emission reduction potential change over time?

3. **Ease of technology availability and applicability**. What is the availability status of the control technology? Is it readily applicable to new and existing emission sources?

4. **Impacts on health, environment and global climate change**. To what extent will the ERM affect health and environment? Will its application affect emission of greenhouse gases?

5. **Impacts on other media**. Will the ERM transfer pollution to any other media such as water and land?

6. **Regulatory tools**. Do the necessary regulations exist to implement the ERM or would amendments to existing regulations or enactment of new regulations be required?

7. **Effects on other ERMs**. Will implementation of this particular ERM enhance or reduce the effectiveness of other ERMs?

8. **Cost-effectiveness**. What will be the estimated initial start-up, short-term and on-going operational costs of the ERM? What is the cost-effectiveness of the control measure in terms of cost per tonne of pollutant reduced?

Source: Bhattacharyya, Kamal K. (1999) Urban Air Quality Management: A Framework for Development and Implementation. World Health Organization.

For the GVRD AQMP, Emissions Reduction Measures were chosen based on a study of current and future emissions levels and an evaluation of control measures as to their cost effectiveness, their applicability to emissions sources, and their technical feasibility. ERMs were assessed for the five criteria contaminants and measures were developed for the sources that comprised the top 75% of emissions for each contaminant, for each source type. The assessment of ERMs was presented in the GVRD AQMP Stage Two Report (Levelton, 1993).

Whenever possible, measures were assessed according to dollar cost per tonne of pollutant reduced.

11.2 A Brief Summary of Emission Reduction Measures Recommended in Other AQMP's

11.2.1 GREATER VANCOUVER REGIONAL DISTRICT

The GVRD is responsible for regulating point source emissions within its boundaries. A variety of ERMs were introduced to reduce point source emissions, such as switching to low emission raw materials, solvents, and fuels; changes in operating practices to minimize pollutants, and installation of the most recent retrofit control technologies.

There were 13 ERMs selected to reduce VOC emissions from area sources. Specific sources targeted in these ERMs included gasoline marketing, surface coating, direct solvent use activities, and consumer products. The strategies set forth in these measures included add-on controls and product substitution. Other ERMs were targeted at reducing emissions of NOx and SOx from space and water heating systems. Measures to reduce PM emissions from construction and demolition activities were also included.

Specific recommendations for area source emissions reductions included: the 1995 Space and Water Heating Regulatory provisions contained in the National Building Energy Efficiency Code, which

requires energy efficient heating units in homes, commercial, industrial, and institutional buildings, and regulates SOx content in heating oil. The 1993 Open Burning Smoke Control Regulation was also cited. A broad range of measures and strategies were recommended to reduce emissions from mobile sources. Initiatives include new car increased fuel efficiency (for both heavy and light duty vehicles), and low emitting fuel/engine technology. Inspection and Maintenance Programs for both light duty (AirCare) and heavy duty vehicles, TDM (improved transit, HOV lanes, transit priority in congested traffic, etc.), alternative and reformulated fuels, enhanced vehicle emissions standards, and zero emissions vehicles are other proposed ERMs targeting this source type. Modifying land use patterns to reduce dependence on the automobile was also recommended.

Other measures pertaining to mobile source emissions reduction include a continued commitment to the BC Transit Go Green Program, technical assistance for employer based trip reduction program planning, and the development of regional ride sharing initiatives. These ERMs are contained within the GVRD's Trip Reduction Program.

11.2.2 PRINCE GEORGE

Fine particulate matter and TRS represent the priority air contaminants addressed in the Prince George AQMP.

Phase One of the AQMP recommends the implementation of several ERMs to reduce fine particulate emissions from point sources. The banning of Beehive Burners, upgrading of pulp mill power boilers, and requiring sources of wood residuals to make these materials available for use in viable value added projects, were among the recommended ERMs for this source category.

It was recommended that major point sources of TRS emissions be required to identify options for TRS emissions reduction at their operations.

The recommendation that the City and Regional District take effects on air quality into account when identifying new areas for heavy industrial development, was also included.

Major strategies to reduce fine particulate emissions from area sources included measures to reduce dust from street sanding and unpaved roads, and to reduce emissions of PM10 from wood burning appliances and backyard open burning. The AQMP also calls for the integration of air quality considerations into future revisions of the Prince George Community Plan.

Recommendations were also put forward for pollution prevention management actions. These recommendations are intended to prevent future air quality problems from developing. The focus being on air contaminants that are at present within acceptable levels, but have the potential to increase significantly in the future given further community and industrial development. Requiring that all proposed new projects, which will be significant emitters of air pollutants, be assessed through the provincial Environmental Assessment Program before approval is granted, is one of the recommendations proposed to facilitate pollution prevention. It was also recommended that WLAP approve new facilities that are planning to use the best available emissions control and reduction technologies. The promotion of reduction in mobile source emissions was also endorsed.

12.0 CONCLUSION

An Air Quality Management Plan can be an effective and comprehensive tool for addressing air quality issues in the STS airshed by bringing together the resources and ideas of partners, stakeholders, and community members to produce a comprehensive road map for the protection of this resource, which will foster broad community involvement both in plan development and implementation. This planning process allows for both the maintenance and protection of air quality while also meeting the needs of the communities in the airshed.

The AQMP provides for a broad focus to address emissions from point, mobile and area sources of air pollutants. This report has highlighted the particular need to address these latter two source types. Area and mobile sources have been largely unaddressed in the past and are the source types where future increases in emissions are expected to be very significant, as the number of these sources continues to increase with continued population growth in the airshed.

This report has outlined the major activities involved in the development of an Air Quality Management Plan for the Sea-to-Sky Airshed. The status of ambient air quality monitoring resources and emissions assessments completed specific to the STS Airshed were also reviewed. Recommendations for potential partners in the AQMP process, including potential contributions each could make in moving the AQMP process forward, was summarized. In addition, a brief overview of work completed and underway in other airsheds, specifically the Lower Fraser Valley airshed, the Prince George area, and the Williams Lake-Quesnel region, was provided.

The leadership of local governments and other local community leaders will be essential in moving this process forward, since these groups have the jurisdictional authority and local community relationships necessary to effectively address these non-point sources of air pollutants, while meeting the needs and goals of the communities within the airshed. Provincial and national government agencies can provide the regional and national perspectives, respectively, as well as providing technical assistance and information in their respective areas of expertise.

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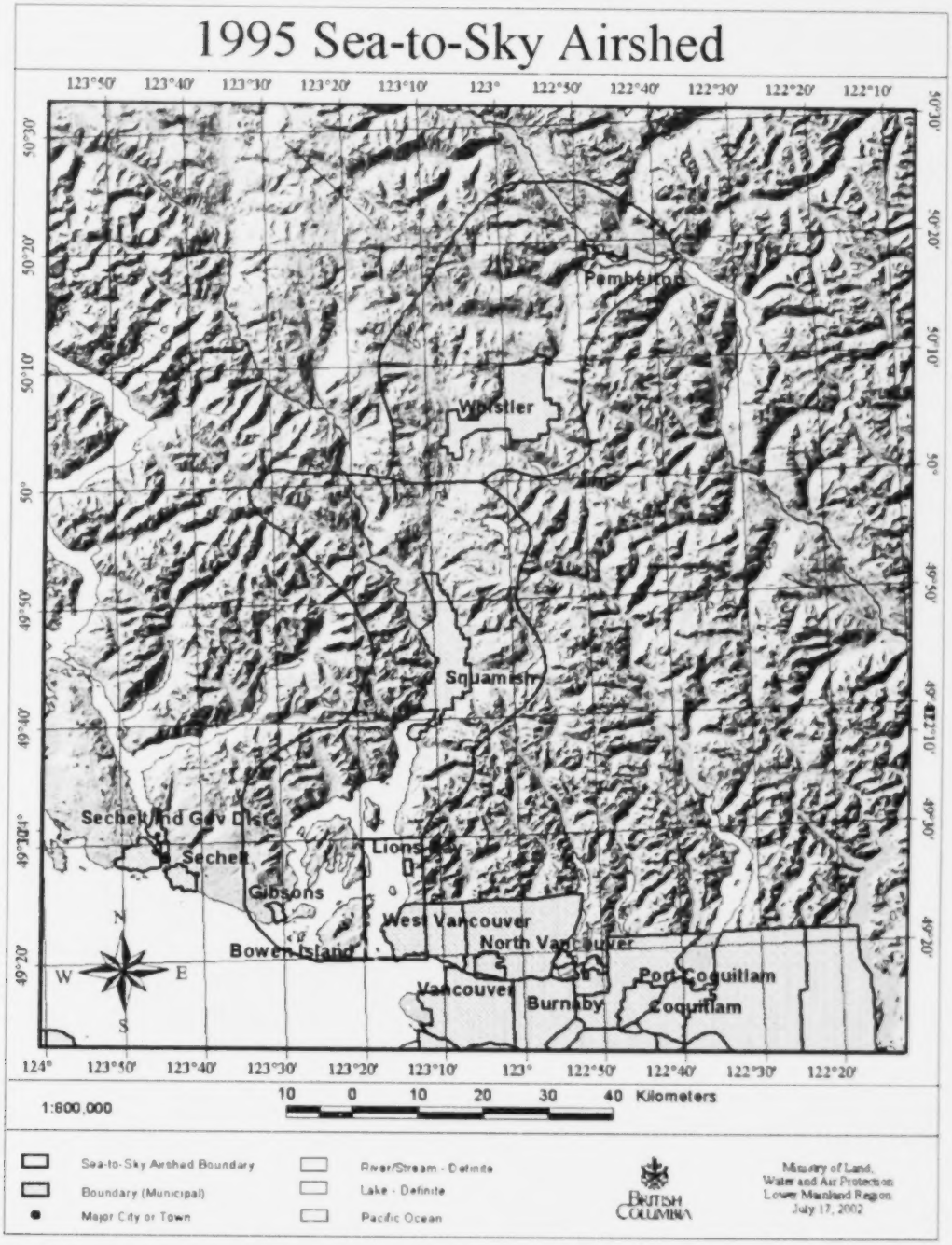
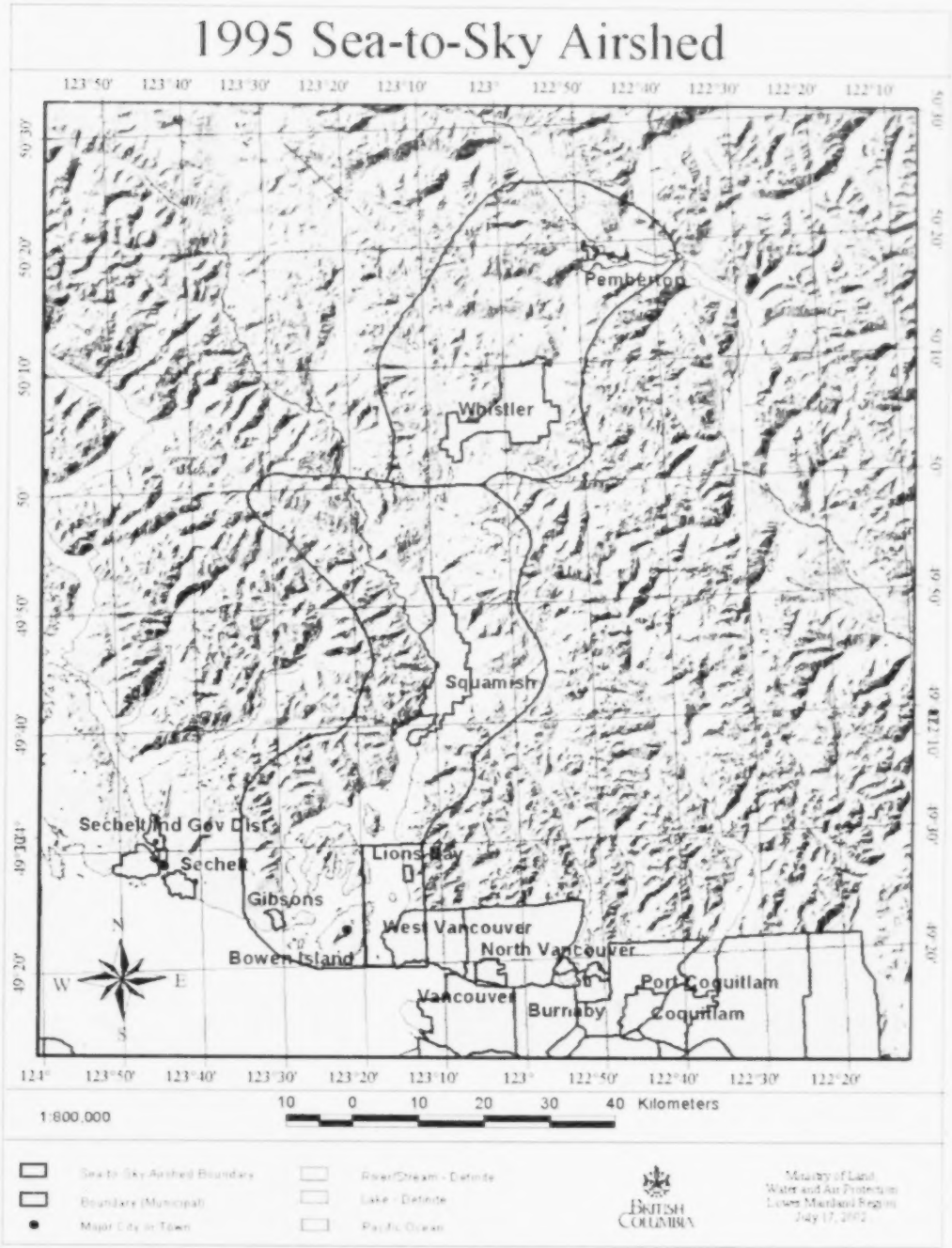


* The rectangular box (bordered to the east by 123° 20' and to the south by 49° 20') in the southeast corner of the airshed is included in the Sea-to-Sky airshed, but is within the administrative jurisdiction of the GVRD



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APPENDIX B
Stakeholders in the Sea-to-Sky Airshed

The main communities in the Sea-to-Sky airshed are Bowen Island, Gibsons, Horseshoe Bay, Lions Bay, Squamish, Whistler, and Pemberton. There are also several smaller communities in this area. However, for the purposes of this report, a list of stakeholders was compiled only for these seven communities. This list provides representative groups for the major interests in these communities. The organizations listed below are those that are likely to have an interest in air quality, or the potential initiatives associated with it. They may be potential sources of information and expertise, able to aid in finding further community contacts, sources of volunteers for future projects and programs, or sources of funding. Unless otherwise indicated with a contact name, the following contact information is general.

1. GOVERNMENT

- Ministry of Water Land and Air Protection
- Ministry of Health
- Ministry of Forests
- Ministry of Transport
- Municipalities and Districts
  - District of Squamish – 604 892-5217
  - Pemberton Village – 604 894-6135
  - Resort Municipality of Whistler
  - District of Bowen Island 604 947-4255
  - Lions Bay Village 604 921-9333, Fax: 604-921-6643
  - Horseshoe Bay (Part of Municipality of West Vancouver)
  - Gibsons
- Environment Canada
- Squamish-Lillooet Regional District
- Greater Vancouver Regional District
- Regional District of the Sunshine Coast

2. OTHER AGENCIES

- British Columbia Ferry Corporation
- British Columbia Transit
- University Researchers (e.g. UBC Roland Stull, UNBC Peter Jackson)

3. INDUSTRY

Gibsons

- Howe Sound Pulp & Paper (Port Mellon)
- Bayside Saw Mills
- Centra Gas (compressor station for natural gas pipeline)
- Council of Forest Industries of British Columbia (COFI)

Squamish

- International Forest Products Sawmill (Squamish, Garibaldi)
- Western Pulp Inc. (Woodfibre)
- British Columbia Rail Maintenance Facility
- Squamish Terminals Limited
- Squamish Harbour Authority

Squamish cont'd

- Halray Logging Ltd.
- Cardinal Concrete Ltd. (Squamish)
- Osprey Mining and Exploration (Squamish)
- Rasio Chemicals Canada (Squamish)
- Squamish Mills Ltd. (Squamish)

Whistler
- Function Junction (includes some light manufacturing)
- Cardinal Concrete (Whistler)

Pemberton
- Continental Pole (Mount Currie)
- C.R.B. Logging Co. Ltd. (Pemberton Valley)
- Probyn Log Ltd. (Pemberton Industrial)
- Albeth Contracting Ltd. (Pemberton)

4. BUSINESS

Transportation
- Greyhound
- Squamish Coachlines Ltd.
- Maverick Coachlines

Bowen Island
- Bowen Island Chamber of Commerce
- C & C Logging

Gibsons
- Gibsons Chamber of Commerce

Squamish
- Squamish Chamber of Commerce
- Downtown Merchants Association
- Squamish District Labour Committee

Whistler
- Chamber of Commerce
- Tourism Whistler
- Whistler Mountain Ski Corporation
- Blackcomb Mountain
- Tyax and Whistler Heliskiing

Pemberton
- Chamber of Commerce

5. LOCAL MEDIA

Bowen Island
- The Undercurrent (newspaper)
- Island News (published monthly)

Gibsons
- Coast Independent (newspaper)
- The Reporter (weekly newspaper)

Squamish
- The Squamish Chief (newspaper)
- Squamish Community 10 (television)

Whistler
- Sea-to-Sky Voice (newspaper)
- Whistler Question (newspaper)
- The Peak (newspaper)
- Mountain FM
- Whistler Television

Mount Currie Indian Band
- Ruthdick (newspaper)

6. ENVIRONMENTAL GROUPS

Bowen Island
- Bowen Island Nature Club
- Bowen Island Alliance
- Bowen Island Fish and Wildlife Club

Squamish
- Squamish Estuary Conservation Society
- Squamish River Watershed Society
- Soo Coalition for Sustainable Forestry

Whistler
- AWARE

7. FIRST NATIONS

Squamish
- Squamish Nation

Pemberton
- Mt. Currie Band
- N'Quatqua First Nation

8. COMMUNITY ORGANIZATIONS

- School District 48 (Howe Sound)
- Sea-to-Sky Economic Development Commission

Bowen Island

- Bowen Island Parks and Recreation
- Island Pacific School
- Bowen Island Community School Association
- Bowen Island Public Library
- Bowen island Senior Association
- Bowen Island Arts Council
- Bowen Island Improvement Association
- Bowen Island Community Care Society

Gibsons

- Sunshine Coast Community Services
- Gibsons Wildlife Rehabilitation Centre
- SC Regional District - Recreation Programs
- Coast Cultural Alliance Web Site
- Kinsmen
- Lions Club
- Rotary Club

Squamish

- Squamish Community Future Development
- Squamish Public Library
- Sea to Sky Community Services
- Howe Sound Round Table (
- Squamish Volunteer Centre Society
- Squamish Arts Council Directory
- Capilano College Squamish Campus
- Squamish Compost Demonstration Garden Hotline
- Squamish Senior Citizens Home Society
- The Jack Bell Foundation
- Rotary Club of Squamish
- Squamish Lions Club

Whistler

- Whistler Public Library
- Whistler-Pemberton Big Brother Big Sisters
- Whistler Community Services Society

Pemberton

- Pemberton Public Library
- Pemberton Community Centre

9. HEALTH

- Coast Garibaldi Health Unit
- BC Lung Association
- Pemberton Health Centre

GREATER VANCOUVER REGIONAL DISTRICT

The GVRD AQMP was released in 1994 and the most recent "Implementation Status Report" for the AQMP was released in 2001 (GVRD, 2001). The aim of the GVRD AQMP was to reduce emissions of the five criteria pollutants by 50% compared to 1985 levels. It is a comprehensive plan including information on the air quality issues in the regional district, air quality monitoring and emissions inventory results, and emissions forecasts. The Plan also includes emissions reduction measures (ERMs) for all major sources for the priority Air Quality issues involving mobile, area, and point sources, and timelines for their implementation.

Currently, the GVRD is working on the development of joint air quality management planning with the FVRD. The GVRD is also interested in linking planning for reduction in Common Air Contaminant emissions with further planning for reductions in greenhouse gas emissions (Sheltair, 2000).

In preparation for the development of the GVRD AQMP, the GVRD prepared several working papers exploring a variety of relevant areas including topics such as, regional trip reduction programs, fine particulate and visibility, residential wood burning stoves and fireplaces, and the GVRD's role in global atmospheric change initiatives. In addition, reports were prepared in conjunction with the GVRD's Transport 2021 program, which included recommendations for both a long-term and medium-term Transportation Plan for the region that address environmental objectives. The GVRD's Creating Our Future and Livable Regions strategies were also prepared; the former acting as a backbone for the GVRD AQMP.

The GVRD AQMP was developed through the preparation of incremental reports as the AQMP progressed. The GVRD AQMP Stage One Report (1989) was designed to assess current and future air quality, and included topics such as, climatology, past, current, and future air quality, air quality objectives and episode management, air quality modeling, and current and future emissions.

A second report (Stage Two Report, 1993) outlines and assesses the effectiveness of emissions reduction measures in addressing priority air quality issues, and the major emissions sources in the airshed. Stakeholders were given the opportunity to review and provide input to this report.

The GVRD Air Quality and Source Control Department prepared the GVRD AQMP with input from BC Environment (now WLAP) and other government agencies, as well as from the Air Quality Advisory Committee. Representatives of the GVRD member municipalities formed the GVRD Air Quality Committee, and have endorsed the Plan.

The GVRD and FVRD are planning on working together to produce an integrated air quality management strategy. In addition, the Air Quality Co-ordination Committee was established to co-ordinate air quality management efforts between the FVRD, GVRD, and Watcom County (represented by NWAPA in this process), which all share the same airshed. WLAP and Environment Canada are also participants in the AQCC, which meets every two months. Members bring forward air quality related issues, including upcoming policy and strategy development, potential new emissions sources and changes in the status of existing emissions sources, for discussion, review, and co-ordination with the other AQCC members. In addition, AQCC members also break off into sub-committees which meet regularly. Sub-committees have been formed for air quality monitoring, emissions inventories, and air quality planning.

FRASER VALLEY REGIONAL DISTRICT (FVRD)

The FVRD released its AQMP in 1998. This plan outlines the air quality issues and goals in the airshed, and jurisdictional allotment of responsibilities concerning air quality, as well as providing a summary of air quality monitoring and emissions inventories performed to date. It also provides general recommendations for air quality policy and strategy options for a future FVRD AQMP. Specific emissions reduction measures still need to be developed.

The FVRD is working toward a joint air quality management planning process with the GVRD. The FVRD is also working with the provincial government to arrange for delegation of powers, for air quality management and for monitoring of compliance, covered under the *Waste Management Act*.

PRINCE GEORGE

Phase One of the Prince George AQMP was released in 1998. Phase One of the AQMP includes a summary of air quality issues as well as recommended emissions reduction measures for point and area sources for the priority air contaminants in the airshed (PM10 and Total Reduced Sulfur (TRS)). Drafting and release of Phase One of the AQMP was completed in approximately three years.

Currently, Prince George is working on implementation of the AQMP including refinement and implementation of management strategies, continued air quality monitoring, and the exploration of options for air quality modelling and other research.

In Prince George, a background report was developed for the AQMP that included an analysis of ambient air quality, emissions sources, and the status of respiratory health in Prince George. The Report contained recommendations for priority air contaminants and priority sources for reduction, and options for management of emissions sources. Preparation of this Report was completed in under a year.

The Prince George AQMP process convened an Airshed Technical Management Committee to develop the AQMP. The ATM Committee consisted of representatives from the following groups: City of Prince George Public Works and Development Services Departments, Regional District of Fraser-Fort George Environmental and Development Services, WLAP Environmental Section, Northern Interior Health Unit, University of Northern BC, and College of New Caledonia. The Committee was formed to prepare a co-ordinated Air Quality Management Plan.

WILLIAMS LAKE-QUESNEL

The Williams Lake-Quesnel Air Quality Management planning process is currently in its initial phase. The revised "Framework Outline for Airshed Management Planning in Quesnel and Williams Lake" was released in 1999.

Currently, development of the AQMP is moving forward. An emissions inventory has been conducted for the area and air quality modelling using CALPUFF has been completed. In addition, a five-year Air Quality Monitoring and Assessment Strategy has been prepared for the airshed (Plain and Zirnhelt, 2000).

The Williams Lake-Quesnel AQMP is being developed through the work of an Air Quality Management Committee. The committee is chaired by the Environment Society, the group which spear headed the effort to initiate air quality management planning in the district. Other partners on the committee include: WLAP, Ministry of Forests, Ministry of Health, Ministry of Transportation, Cities of Quesnel and Williams Lake, business and industry, community associations, school teachers and College representatives, and the Regional District. Efficient use of committee members' time is maximized by forming sub-committees to tackle specific issues (such as road dust) and by circulating meeting agendas to allow members the opportunity of selecting meetings with topics of concern to them. The committee is focused on providing solutions and is finding that the varied expertise available among members is extremely valuable.